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Christine Spare
(TYPED NAME OF PERSON MAILING PAPER OR FEE)

Christine Spare
(SIGNATURE OF PERSON MAILING PAPER OR FEE)

GOLF BALL TEE-UP MECHANISM FOR GOLF DRIVING RANGE

Cross Reference to Related Applications

This application is a continuation-in-part of Serial No. 10/042,645 filed January 8, 2002 bearing the same title, and being itself being a non-provisional based upon a provisional application Serial No. 60/260,257 filed January 8, 2001. Both applications are incorporated herein by reference.

Field of the Invention

This invention relates to an apparatus for setting up individual golf balls on a golf tee at a bay or hitting station, such as a bay typically provided at a golf driving range. The present invention deals more particularly with such an apparatus that is capable of receiving golf balls from a storage chamber from which individual golf balls are fed to a point adjacent the tee area.

Background

Golfers often use driving ranges for practice and improvement. Golfers at a driving range often identify, either mentally or through a coach, the specific cause of an improper swing immediately after hitting a ball. This identification may be facilitated or reinforced by viewing the ball trajectory. A phenomenon known as muscle memory aids in improving a specific cause of an improper golf swing when the next subsequent swing is taken soon after the first and with minimal bodily movements therebetween. Manually bending to take a ball from a basket and place it on a driving range tee abates the advantage of muscle memory since numerous muscles unrelated to those bearing

on swing improvement undergo large movements in teeing up the next ball. An automatic tee-up device would avoid much of the diminishment of muscle memory so long as less muscle movement is required to actuate it than is required to manually tee up a ball. Such a device would aid in more rapidly improving the swing of golfers practicing at a driving range.

The present invention is directed toward curtailing or eliminating the aforementioned recurrent bending and standing at a golf driving range, which in itself may aggravate a golfer's pre-existing back pain. An apparatus according to the present invention may be used in series with certain golf ball gathering and processing machines, such as those described in co-owned U.S. Patent Numbers 5,350,260, 5,332,350 and 5,228,168, to further automate processes at a golf driving range. For example, a golfer may manually deposit a basket of balls into a temporary storage basket that feeds an adjacent apparatus according to the present invention. More automated processes may include remotely feeding from a central storage container an apportionment of golf balls via pneumatically driven tubes to a similar storage chamber proximal to the tee, or feeding a predetermined number of balls individually to an apparatus of the present invention as the golfer hits the previous ball.

Summary of the Invention

In accordance with the present invention, an apparatus for teeing up individual golf balls at a hitting station is provided comprising a tee for supporting a golf ball at the hitting station and delivery means for providing golf balls at the hitting station. A golf ball passageway is also provided for transporting the golf balls seriatim from the delivery means to the tee. The golf ball passageway is movable between a lowered position that is below the tee, and a raised position wherein at least an exit end portion of the passageway is vertically higher than a top of the tee. The apparatus also includes means for moving the passageway between the lowered and raised positions, and an escapement mechanism to release each golf ball from the delivery means onto the tee when the passageway is in the raised position.

Also according to the present invention is an apparatus for setting a golf ball on a

tee, comprising a chute defining a first end and an opposing second end for transporting the golf ball to the tee, and escapement means for separating an individual golf ball from a plurality of golf balls and for delivering the individual golf ball to a first end of the chute. This apparatus further includes means for moving the chute between a first position clear of the tee so the ball on the tee can be struck by a swinging club, and a second position wherein the second end of the chute is vertically higher than a top of the tee.

In accordance with a second embodiment of the present invention, the movable chute is replaced by a fixed chute that delivers each golf ball in turn to an inclined groove in a ramp, the groove communicating with a groove directed at the tee opening at the platform. The tee opening receives the ball delivered thereto by the groove or grooves, and the tee raises the ball up so that it can be struck by the golfer. Once struck, a sensing device is provided for in the tee raising mechanism so as to cycle the apparatus and provide the delivery of a second golf ball while the tee is being retracted for this purpose. Once raised up the ball can then be struck and the cycle repeated.

Brief Description of the Drawings

Figure 1 is a plan view of the preferred embodiment of the present invention with certain portions cut away.

Figure 2 is a view along section line 2-2 of Figure 1, with a movable platform of the apparatus in a raised position

Figure 3 is a view along section line 2-2 of Figure 1, with a movable platform of the apparatus in the lowered position.

Figure 4 is a view along section line 4-4 of Figure 1.

Figure 5 is a partial view along section line 2-2 of Figure 1 showing selected components of a ball weighing mechanism and an adjustable tee height mechanism.

Figure 6 is a schematic view of the mechanism that raises and lowers the movable platform.

Figure 7 is a flow diagram of the cycle for the mechanism of Figure 6.

Figure 8 is a perspective view illustrating the improvement provided for in an alternative embodiment of the invention.

Figure 9 is a side elevational view thereof.

Figure 10 is a view similar to Figure 9 but illustrating the apparatus with the hopper/cover removed.

Figure 11and 12 show the golf ball tee raising and lowering mechanism in its lowered position for receiving a ball.

Figure 13 shows the same mechanism of Figure 13, but with the golf ball tee raised after the ball has been positioned in the opening of the platform.

Figure 14 shows the mechanism for cycling the ball escapement and golf ball tee raising and lowering mechanism.

Figure 15 and 16 show details not revealed to Figures 13 and 14.

Figure 17 shows the cycle for the mechanism of Figure 14.

Detailed Description of Figures 1-7

A fuller appreciation for the present invention may be achieved by reference to the associated illustrations, wherein Figures 2 and 3 show elevational cross sections exposing some essential components of the preferred embodiment in differing positions. Figure 1 provides an overview wherein a right-handed golfer at a driving range would stand at position A and would drive a golf ball 12 mounted on a tee 14 downrange toward the top of the illustration. Throughout this description, vertical is parallel to a gravitational force and horizontal is perpendicular thereto.

Figure 1 depicts a golf ball 12 restrained against gravity by an escapement mechanism 18 from entering a first end 40 of the chute 20 until the chute 20 is in a raised position. The golf ball 12 then travels down the chute 20 until abutting against a stop 50, at which time it falls through a tee opening or void 28 on the underside of the chute 20 and rests upon a tee 14. The chute 20 is attached to a movable platform 26 that is attached to a fixed platform 30 at a hinge 36. A finishing section 37 remains fixed, and hides from view the underside of the movable platform 30. Once the golf ball 12 rests on the tee 14, the movable platform 26 is moved to its lowered position by a mechanism within the cabinet 48, detailed later herein.

A plurality of golf balls may be retained within a storage basket 16 located

proximal to the cabinet 48. A conduit 70 allows golf balls to move between the storage basket 68 and the chute 20 in a single file line of balls. The conduit may be straight or curved, may hold one or several balls, and can itself constitute a storage chamber. The escapement mechanism 18 is located along the conduit and allows only a single ball to pass onto the chute 20 at a time.

The chute 20 is movable between a raised position illustrated in Figure 2, and a lowered position illustrated in Figure 3. The chute 20 is mounted to a movable platform 26 and defines a tee opening or void 28 large enough for a golf ball 12 to pass via gravity. Immediately adjacent to the void 28 is a stop 50 disposed to prevent a golf ball 12 rolling along the chute 20 from passing beyond an axis of vertical alignment 52. An axis of vertical alignment 52 is hereby defined as any vertical axis passing through both the golf ball's center of gravity and a portion of the tee 14. The axis of vertical alignment is not limited to the central axis of rotation of the golf tee, but includes any vertical line passing through the golf ball center of gravity and falling within a circle defined by the top of the golf tee.

The movable platform 26 is hingedly mounted at one end to a fixed platform 30 at a hinge 36. A first end 40 of the chute 20 is attached to a motor means that moves the first end 40 between the lowered (Figure 3) and raised (Figure 2) positions via mechanical connections described below. In the raised position, a single golf ball is released by the escapement mechanism 18 into the first end 40 of the chute 20. The ball 12 rolls via gravity along the chute 20 until abutment with the stop 50. This puts the golf ball 12 on an axis of vertical alignment 52 with the tee 14. The golf ball 12 then falls via gravity through the void 28 onto the tee 14. The movable platform 26 is then retracted to a lowered position, shown in Figure 3, so that it will not interfere with a golfer's swing at the ball 12. The lowered position is that position wherein the first end 40 of the chute 20 lies vertically lower than the top 38 of the tee 14.

A mechanical assembly to raise and lower the first end 40 of the chute 20 is preferably substantially enclosed within a cabinet 48 to protect the assembly from rain, snow, and the occasional erratic golf swing. Figure 4 portrays a view of the mechanical

assembly along the section line 4-4 of Figure 1, and Figure 6 shows the same assembly schematically. The mechanical assembly comprises a motor 32 with a driven pulley 42 attached to a rotating axis thereof, and a means to transfer motion such as a belt, chain, cable, or rope 44 (hereinafter referred to only as a chain) passing about the driven pulley 42 and a freewheeling pulley 54. A transition cable 56 has a first end 58 pivotally attached to the chain 44 via an anchor 60, and a second end 62 attached to an upper hook 64 of a means to extend under tension, such as a helical coil spring 34. The means to extend under tension may alternatively include resiliently deformable plastic, elastic, rubber, or similar materials that are extensible under tension and regain their original dimension upon release of tensile force. A lower hook 66 of the helical coil spring is attached near but offset from the first end 40 of the chute 20 so as not to obstruct a ball from entering the chute.

The motor 32 operates through the chain 44 and the cable 56 to lower the entire spring 34 and place the first end 40 of the chute 20 in the lowered position 22 of Figure 3 so that a golfer may swing at the teed up ball unencumbered. As the motor 32 drives the chain 44, the transition cable 56 raises or lowers the spring 34 in its entirety without extending it appreciably. The same operation may be accomplished by eliminating he spring and using a somewhat longer transition cable than the one depicted to account for the additional length lost by the spring. However, the best mode encompasses the spring as shown so that a golfer stepping on a raised or rising platform will merely drive the platform to its lowered position (or prevent it from rising) by extending the spring rather than by damaging the device. The spring also extends modestly between the time when the movable platform first reaches its uppermost position and the time when the transition cable is drawn in to its maximum extent (as shown in Figure 6 with the anchor at the lowest point of the freewheeling pulley). This 'overshoot' range positively ensures the motor brings the chute to the proper raised position.

The escapement mechanism provides only a single golf ball 12 from a storage basket 16 to the chute 20 at a time. A storage chamber may be internal to the cabinet 48, may be mounted adjacent thereto as the basket shown in Figure 1, or may be remote as when the present invention is combined in series as explained in the "Background"

section herein. One embodiment of the escapement mechanism employs a gate system. In this embodiment, a release gate and a retention gate are fixedly attached to each other and flank either side of a single ball nearest the chute. The release gate is positioned on the side of the ball nearest the chute and the retention gate is adjacent to the opposing side of the ball.

When the chute is in the lowered position, the release gate is closed to prevent any golf balls from passing through, and the retention gate is open so that a plurality of golf balls lie in an uninterrupted line or aggregation leading toward the chute. When the chute rises to the raised position, an extension or tab protruding from the chute simultaneously drives the retention gate upward into a position that blocks the passage of golf balls behind the retention gate, and drives the release gate upward into a position that allows the passage of golf balls. The retention gate physically isolates the golf ball nearest the chute from other balls in a line or aggregation behind it, so that only the golf ball nearest the chute is unencumbered by the retention gate in this position. The release gate and retention gate are fixedly attached to each other so that they simultaneously operate. As one is moved into position to block the passage of a golf ball toward the chute, the other is moved from a similar but offset blocking position. When the rising chute drives the release gate upward and above the conduit, the golf ball nearest the chute passes via gravity onto the raised chute, but golf balls behind it are held back by the retention gate that is moved into a blocking position. When the chute is subsequently lowered, the release gate drops via gravity into the blocking position that obstructs the conduit and prevents any golf balls from passing toward the chute. The retention gate simultaneously drops from its blocking position to a position below the conduit that does not obstruct movement of golf galls toward the chute. The remaining uninterrupted line or plurality of balls is thereby held back by the release gate only. The gates may be located proximal to the chute, or remotely therefrom by using an actuator other than an extension of the chute. Alternatively, a rotating escapement mechanism such as that shown in co-owned U.S. Patent Nos. 5,228,168 and 5,350,260 may be used, adapted for a single ball and hereby incorporated by reference. Other prior art teachings and knowledge in the art for isolating one ball from several in a line may also be easily adapted to serve as the escapement mechanism.

An actuator switch may also be appended to the motor so that a golfer may manually actuate the motor to begin the cycle of teeing up the next subsequent golf ball. This switch may be manually operated by foot, by golf club, or by hand. Alternatively, minor modifications can make the switch automatic. Examples of automatic sensors to initiate an automatic cycle include an optical or ultrasonic sensor located either within the cabinet or below the tee. Another example is a weighing mechanism connected to the tee itself. Any of these sensors could detect when a ball is present upon the tee by light or sound reflection from the ball or by weight on the tee. When the sensor detects the absence of a ball on the tee, the sensor causes the motor to be actuated and the next golf ball to be delivered to the tee.

One embodiment of an automatic sensor to initiate teeing up of the next subsequent ball coupled with a manually adjustable tee height is illustrated in Figure 5. This shows a view along a portion of the section line 2-2 of Figure 1, with only the components relevant to the sensor and tee height mechanism depicted. The fixed platform 30 and movable platform 26 are as previously described. The tee 14 is fixedly mounted near one end of a tee arm 72. The tee arm 72 is mounted at a pivot 73 to a carrier arm 74, which is itself hingedly mounted at one end to a mount 76. Rotation of the tee arm with respect to the carrier arm is mechanically limited. Due to oversize driver club heads, the best mode contemplates this mechanically limited rotation allow the tee to move vertically at least one inch. The pivot 73 is positioned such that, absent a weight on the tee 14, the tee 14 is biased to a raised position as shown. A load cell device 78 having a pressure sensor 80, such as a piezoelectric element, is fixedly attached to the end of the carrier arm 74 nearest the mount 76 such that the pressure sensor 80 is positioned above the tee arm 72. The carrier arm defines a free end opposite the mount. A rigid bracket 82 defines an upstanding arm 84 and a laterally extending arm 86, and is positioned such that the carrier arm free end rests on the laterally extending arm 86. The bracket 82 is hingedly mounted to a bracket mount 88. The upstanding arm 88 is attached to one end of a cable 90, preferably a rigid sheathed cable that can drive the upstanding arm in tension or compression. Extension or retraction of the cable 90 causes the bracket 82 to pivot about the bracket mount 88,

raising or lowering the laterally extending arm 86, the corresponding free end of the carrier arm 74, and ultimately the tee 14. The cable 90 does not forcibly lock into position. This helps prevent damage by allowing the carrier arm 74 and/or the bracket 82 to rotate, should a person step on or force down the tee 14.

The cable 90 leads into the cabinet 48, and is therein connected to a lever arm 92 that is itself hingedly connected at a lever arm pivot 94 to the cabinet 48 or to a suitable support member. A handle 98 opposite the lever arm pivot 94 extends beyond the cabinet 48 for manual positioning of the tee height by a golfer. The handle, and thus the tee height, is held in place by non-locking physical detents or by friction. Preferably, the cable 90 connects to the lever arm 92 at a point between the pivot 94 and the handle 98. This results in movement of the tee 14 in a direction commensurate with that of the handle 98, as a convenience to the golfer using the tee up apparatus.

When a ball is on the tee 14, the tee arm 72 is depressed against its bias to rest against a mechanical stop in a position approximately parallel to the carrier arm 74. When there is no ball or additional weight on the tee, the tee arm 72 pivots relative to the carrier arm 76 as shown in Figure 5 to raise the tee 14 a modest distance, preferably more than one inch vertically. This raised tee position simultaneously lowers the end of the tee arm 72 adjacent to the load cell device 78. The load cell device is mounted to the carrier arm 74, but its pressure sensor 80 lies over the tee arm 72. Rotation of the tee arm 72 relative to the carrier arm 74 either loads or unloads the pressure sensor. The load cell device 78 is electrically connected to the motor (Figures 2-3) to initiate a ball tee-up cycle when the pressure sensor 80 is unloaded after being loaded. The cycle of teeing up subsequent balls is set forth in detail below and in Figure 7. After the final ball in a golfer's apportionment of balls is hit off the tee, the load cell device may cause the motor to cycle one last time with no ball being placed upon the tee, but the motor will not continuously cycle since the pressure sensor remains unloaded. An additional switch or sensor indicating the presence or absence of a ball behind either the release gate or the retention gate can be deployed to prevent the final moot cycling of the motor and movable platform. The function of the load cell device may be performed by a microswitch having a plunger positioned over the tee arm, or any number of alternative

sensing devices known in the art that could be wired to actuate the motor.

Figure 7 is a flow chart depicting the cycle of loading a first and successive balls onto the tee. The cycle is initiated when a golfer first approaches the tee, which has no ball upon it and which is biased to the raised position as described above. The golfer taps the tee with his club, shoe, or other implement per block 102. This depresses the tee, causing the tee arm to impose a load on the load cell device. Once the club or implement is removed from the tee, the tee rises again in block 104 due to its bias, and the load cell device is unloaded. This loading and unloading cycle on the load cell device actuates the motor in block 106, raising the platform/chute in block 108. An extension or tab from the raised platform/chute actuates the escapement mechanism in block 110. This logic is presented in flow chart format and can be summarized as follows.

The tee is moved down, by placing a ball, or by depressing it with the club, causing the load cell to trigger the start of a cycle. Motor M is actuated raising the chute, opening the ball escapement. If no ball is present on tee, a ball is delivered. If a ball is present, it must be struck to repeat the cycle.

Description of Alternative Embodiment of Figures 8-17

In the alternative of Figures 8-16, the platform need not include a pivoted portion, and the golf ball delivery mechanism takes advantage of a groove or track provided in the platform, and in a ramp inclined slightly from the outlet to the golf ball opening in the platform so as to provide momentum for the ball delivered from an outlet pipe provided in fixed relationship in the housing to the groove where it travels slightly downhill onto the platform and comes to rest in the opening provided in the platform through which the golf ball tee will be raised up, thereby lifting the ball for locating the ball so as it can be struck by the golfer.

The mechanism for cycling the apparatus of this alternative embodiment is similar to that described previously, particularly in that the golf ball tee is movable from a lower position where it is below the top surface of the platform to a raised position

where the golf ball is lifted clear of the platform so as to be easily struck by the golfer. The tee itself may comprise an elastomeric tube as is typical in golf driving range generally, but as in the first embodiment described previously this tee is mounted on a compound lever arrangement.

Turning now to the drawings in greater detail, and referring in particular to Figure 8, a platform 100 is provided with a top surface 100a having a turf-like surface of the type common in golf driving ranges generally. This platform 100 is of conventional construction except for the fact that the tee 114 that supports the golf ball 12 is received in an opening 100b that will permit the tee to move from the position shown in Figure 8 to a lowered position once the ball has been struck, see Figure 11. At that time a golf ball will be delivered from the housing 148 through a small hole or opening 148a onto a slightly inclined ramp 150 which defines a groove 150a aligned with a similar groove 100c in the platform 100 so as to provide a track or groove for the golf ball 12 as it is released from the escapement means, to be described, for travel to the opening 100b in the platform 100.

Still with reference to Figure 8 the housing 148 includes an upwardly open hopper 148b which is adapted to receive a plurality of golf balls such as the golfer might purchase from a dispenser, and dump in the hopper 148b where the balls can be released each in its turn for delivery onto the tee.

Figure 9 shows the above-described components in elevation, and again with the golf ball 12 provided on the tee 114.

Figure 10 shows the apparatus with the housing cover removed, and with the golf ball outlet 130 provided in position to drop a ball onto the fixed chute 150 where the ball can be directed down the groove 150a in the ramp 150 so the ball ultimately travels to and is received in the opening 100c provided for this purpose in the platform 100.

Figure 11 shows the platform 100, with the tee 114 in retracted relationship to the

platform. A compound lever arrangement indicated generally at 160 provides support for the moveable tee 114 on a pivot shaft 162 provided well below the level of the platform 100, below the chute 150.

Figures 11 and 12 are presented without the inclined ramp 150 which delivers the golf ball from the outlet of the chute 130 to the opening 100b and the platform 100. It should be noted that the actual "throw" or displacement provided between the two positions shown for the tee 114 in Figures 11 and 12 can be adjusted by knob 180. Knob 180 is rotatably received in the frame 190, and is coupled to horizontally extending member 170 by conventional linkage indicated generally at 182 for adjusting movement of support 172 in the direction of the arrow 174 so as to alter the relative position of the support 172 for the lever arrangement 160, thereby changing the distance between the support 172 and the shaft 162.

The hopper defined by the cover 148 provides a source of golf balls to be delivered to the inlet end 132 of outlet pipe 130, and it is a feature of this invention that this pipe of conduit is fixed in relationship to the housing 148 unlike the prior art approach calling for a movable chute to deliver individual golf balls to the tee.

The cabinet 148 containing the above described mechanism includes the hopper 148b that provides balls to the inlet 132. This hopper 148b is of generally horseshoe shape, and includes a relatively wide yet shallow portion to one side of the cabinet that tapers downwardly at an angle that is selected to provide for feeding of the balls at a controlled rate into the inlet end of the pipe indicated generally at 132 in the drawings. In its preferred form this generally U-shaped path for the golf balls is so related to the diameter of the balls so as to funnel the balls in an orderly fashion toward this inlet 132.

Turning next to the compound lever arrangement indicated generally at 160 in the drawings, member 170 not only provides for vertical adjustment in the height of the tee 114 as described previously, but this member 170 also carries a transducer 180 in the form of an infrared light sensitive source which signals circuitry to be described. Position information for the tee 114 as this made available to the circuitry to trigger

operation of the escapement and the lever arrangement 160. Tee movement is coordinated with the ball escapement mechanism so that the lever 160 will be in the Figure 11 position to accommodate a ball dropped from the outlet pipe 130, and be raised to the Figure 12 position only after a predetermined time to accommodate the travel of the ball from the escapement through the outlet pipe, onto the groove, and hence into position in the opening 100c defined by the platform 100. Only then will the lever 160 be moved upwardly to the Figure 12 position for presenting a ball to the golfer for hitting.

The tee is spring biased to the lowered position of Figure 11, and driven to the raised position by a motor M having a cable connected to an eccentric wheel at one end, and to a leaf spring at the other end (compare Figures 13 and 14). Thus, in the start position, the tee is down as shown in Figure 11, and the leaf spring together with the associated cable is provided in the position shown at 190 in Figure 14. Initiating of the cycle of operation will drive the motor from the position shown in Figure 14 to that shown in Figure 13 causing the escapement 200 to 100c open, releasing a ball for travel through the pipe into the groove 152 and onto the opening in the platform where it can be lifted by the tee as the tee moves upwardly in response to the above-described motion for the motor and cable as well as the leaf spring.

Thus, the embodiment shown in Figures 8-16 represents a substantial improvement over that described with reference to Figures 1-7. The need for a moving platform as been eliminated, as well as any associated need for providing a movable chute in order to deliver golf balls sequentially from a hopper onto a golf tee. Instead, a stationary chute 150 and groove 100c provide a ball in position for being "teed up" by the mechanism.

Although the prior art does suggest movable tees, the present invention ties in the movable tee with the further feature that no movable chute or ball support mechanism need be provided to deliver the golf balls from the hopper onto that tee.

Summarizing the results achieved with reference to Fig 17, the golfer loads his

allotment of balls into the hopper, and manually adjusts the tee height to his liking, placing a ball thereon if he needs to do so for this "adjustment".

Striking the ball on the tee initiates the cycle, as the weight of the ball will no longer balance the lever 160 on fulcrum 165. After a slight delay, the motor M will lower the tee, and escapement 200 allows a ball to travel from the hopper, through outlet 130 onto chute 150 across groove 100c onto opening 100b. Motor M will cause lever 160 to lift that ball up for striking. This cycle is repeated for as many balls as the golfer might strike after each is provided on the tee.